Promoting Open Access: The Development, Collaborations, and Evaluation of the Kyoto University Rare Material Digital Archive (chapter 3)

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Abstract

This article introduces the development of the Kyoto University Rare Materials Digital Archive and collaborations with external institutions that exploit the International Image Interoperability Framework. The Kyoto University Rare Materials Digital Archive is one of output of the Kyoto University Open Access Promotion Project in which we aim to enhance our research support capability by making any scholarly information available online. In addition, we describe two collaborations: Digital Fujikawa, which is a collaboration with libraries, and the reciprocal links with the SAT Daizōkyō Database, which is a collaboration with a community of researchers. Furthermore, we discuss the challenges we faced when evaluating our archive. Following this, we argue for the importance of the evaluation of open-access digital archives from the perspective of research support.

Keywords: open access, open science, digital library, digital humanities, citation.

1. Introduction

In recent decades, many libraries, museums, and archives have promoted the digitization of resources they hold and made them available on the World

Wide Web. In line with these activities, Kyoto University Library has digitized rare material (e.g., manuscripts, old maps) in the past two decades. The digitized material has been made available in digital archives. In 2016, we launched the Kyoto University Open Access Promotion Project,[1] in which we work for open access of any scholarly information, including scholarly articles and rare material. The author has been working since February 2017 as a project member at the Kyoto University Library. As part of the project, we launched the Kyoto University Rare Materials Digital Archive[2] in December 2017. The digital archive uses the International Image Interoperability Framework (IIIF),[3] which promotes the building of a global and interoperable framework through which images can be easily shared and reused across institutions.

In this article, we introduce the development of the Kyoto University Rare Materials Digital Archive and collaborations with external institutions that exploit the IIIF. Especially, we focus on Digital Fujikawa as a collaboration with libraries and reciprocal links with the SAT Daizōkyō Database as a collaboration with a community of researchers. Then, we discuss the evaluation of digital archives, as evaluation is important for their sustainability. We also describe a couple of our attempts at evaluating the Kyoto University Rare Materials Digital Archive.

The term *digital archive*has been broadly used in different contexts. According to Kate Theimer,[4] there are four primary ways in which it is used:

1. Collections of born-digital records.
2. Websites that provide access to collections of digitized material.
3. Websites featuring different types of digitized information around one topic.
4. Web-based participatory collections.

In this article, we use the term to refer to 2 websites that provide access to collections of digitized material. The Kyoto University Rare Materials Digital Archive provides access to images of rare material that we hold.

The contributions of this article are summarized as follows:

- By introducing the Kyoto University Open Access Promotion Project and the Kyoto University Rare Materials Digital Archive, we describe our activities to make rare material publicly available on the web in the context of open access and open science.
- We describe implementations of collaborations with institutions and a community of researchers that exploit the IIIF. As a collaboration with institutions, we describe Digital Fujikawa, which integrates books of the Fujikawa collection dispersed over different institutions. As a collaboration with a community of researchers, we present reciprocal links with the SAT Daizōkyō Text Database. The reciprocal links present that the distribution enabled by the IIIF benefits both users and institutions that hold material.
- We present our attempts to evaluate our digital archive from the perspective of research support and the importance of such evaluation. Then, we discuss the importance of the evaluation of digital archives from the perspective of research support to further accelerate scholarly communication in the humanities.

The rest of this article is organized as follows: In the subsequent section, we introduce the Kyoto University Open Access Promotion Project as well as the Kyoto University Rare Materials Digital Archive. Thereafter, we describe collaborations with external institutions, in which we virtually connect rare material from several institutions using the IIIF. Finally, we discuss the evaluation of our digital archives before concluding the article.

2. Kyoto University Open Access Promotion Project and Kyoto University Rare Materials Digital Archive

2.1. Kyoto University Open Access Promotion Project

The movement to provide open access to scholarly publications has been evolving over the past two decades with various motivations such as responding to the increase in subscription costs of scholarly journals and

enabling the rapid and free distribution of research output. The Budapest Open Access Initiative (BOAI),[5] held in 2001, defined open access as the free and unrestricted online availability of scholarly literature. One of the driving forces behind the progress of open access since the 2000s is the open-access policies that have been enacted by individual countries, institutions, and funders. An open-access policy usually requires affiliated authors to make their scholarly articles open access. Following this trend, Kyoto University adopted the Kyoto University Open Access Policy in 2015,[6] which mandates faculty members to make their scholarly articles open access by depositing them in our institutional repository, the Kyoto University Research Information Repository (KURENAI).[7] To further promote open access, Kyoto University started the Kyoto University Open Access Promotion Project in 2016. The project comprises the following actions:

1. Promote open access to research output (e.g., scholarly articles and department bulletins) through KURENAI.
2. Enhance resources for research in the humanities and social sciences by digitizing rare material and making it open access in the Kyoto University Rare Materials Digital Archive.
3. Distribute the above mentioned scholarly resources internationally.
4. Develop human resources for the appropriate management of scholarly information in accordance with open science and research integrity.
5. Organize a project team led by experts and train research support staff, including librarians, systematically.

The open-access movement has mainly focused on scholarly literature, especially scholarly articles behind paywalls. Over the past decade, the movement has also made available other resources such as data and even all the processes of science, as one of the foundations of the scientific method is that all work must be reproducible and the only way for that to happen is if all processes are performed openly.[8] In addition, cultural resources have been made publicly available. In this vein, the Open GLAM[9] initiative has evolved, in which cultural-heritage institutions open their collections by

providing access to digital representations of artifacts and metadata about these artifacts. In line with this, the Kyoto University Open Access Promotion Project works toward open access not only of scholarly literature but also of rare material that we hold.

2.2. Kyoto University Rare Materials Digital Archive

As one output of the Kyoto University Open Access Promotion Project, the Kyoto University Rare Materials Digital Archive was made available beginning in October 2017 as a beta version and was officially launched in December 2017. The digital archive supports IIIF, which promotes interoperable image delivery and facilitates the reuse of image resources on the web. The IIIF is organized by a community of libraries, museums, archives, nonprofits, and commercial organizations.[10] The community has defined a set of application programming interfaces (APIs) for the delivery of images and their metadata. These APIs enable external websites to access and reuse images. Specifically, the Kyoto University Rare Materials Digital Archive uses the IIIF Image API and the IIIF Presentation API. The IIIF Image API specifies a web service that returns an image in response to a standard HTTP or HTTPS request;[11] thus, it enables the delivery of images over different websites. In contrast, the IIIF Presentation API[12] delivers descriptive information that is intended for humans to read. It is based on the Shared Canvas data model, which consists of different types of resources.

The digital archive publishes images of rare material held by not only the Kyoto University Library (i.e., the main library of Kyoto University) but also by other libraries and different departments within Kyoto University. As of April 17, 2020, the digital archive provides free access to 1,365,106 images from 17,638 records.

Most of the images in the digital archive are available for any users to copy, adapt, or redistribute in any medium without application or fee under the following conditions[13]:

1. Users must indicate which libraries hold the original image material.

2. When using the images on websites, users must provide links to the images on the archive's website.
3. Users must indicate if modifications were made to images.

Therefore, the images available in the digital archive can be used freely.

3. Collaborations with External Institutions

3.1. Digital Fujikawa—History of Medicine in Japan

The Fujikawa collection is a collection of old medical books that had been collected by Dr. Yu Fujikawa (1865–1940). Books in the collection are stored at multiple institutions, including Kyoto University and Keio University. Researchers on the history of medicine have said that it would be convenient if those books could be viewed in one place. Motivated by them, Kyoto University Library Network and Keio University Media Center have jointly launched a project called Digital Fujikawa–History of Medicine in Japan. This project intends to contribute to the development of research on the history of medicine in Japan by providing a comprehensive view of the Fujikawa collection, which has been physically distributed over different institutions. On September 28, 2018, we released a website[14] that virtually brought the books of different institutions together in one place using the IIIF. As of April 2, 2020, the website delivers 5,333 records from three institutions (i.e., Kyoto University, Keio University, and the University of Tokyo).

Figure 1 shows a screenshot of the top page of the Digital Fujikawa. The page provides a table that lists bibliographies included in the Fujikawa collection. Each row of the table corresponds to a bibliography, including title, kana of the title (i.e., Japanese syllabary), romanization of the title, authors, and published year. In addition, we provide links to Universal Viewer, Mirador, and IIIF Curation Viewer,[15] which are IIIF-compatible image viewers and have different functions and features. The Digital Fujikawa features a search function, using Data Tables.[16] Users search for

old medical books using a search box located at the top right of the table based on metadata shown in columns. In addition, the Digital Fujikawa implements a sort function also using Data Tables.

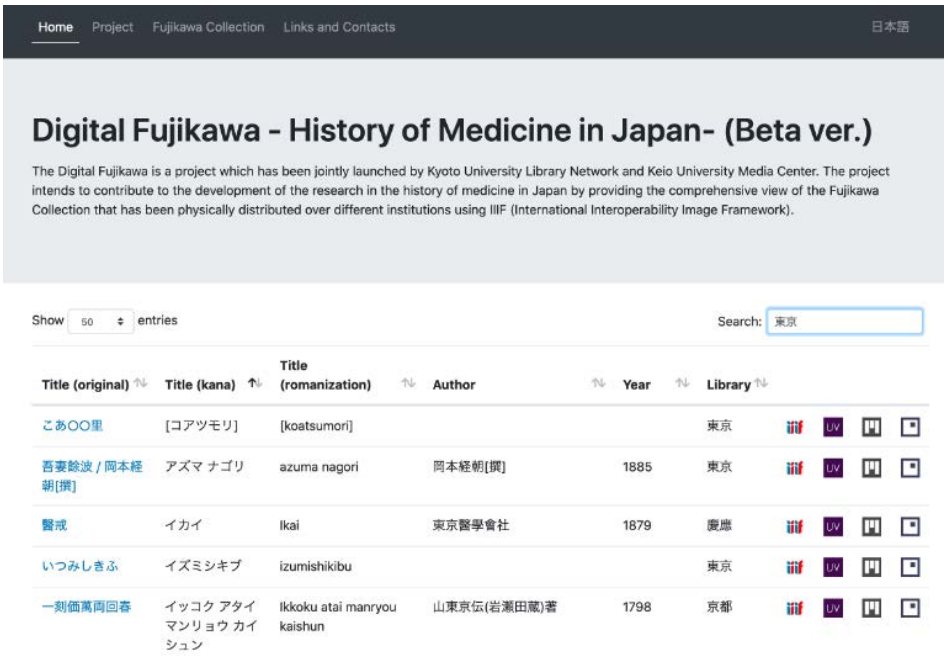

Figure 1. Screenshot of Digital Fujikawa–History of Medicine in Japan.

3.2. Reciprocal Links with the SAT Daizōkyō Text Database

We have added reciprocal links between the digital archive and the SAT Daizōkyō Database.[17] The SAT Daizōkyō Database is a full text-search service for the texts of eighty-five volumes of the Taishō Shinshū Daizōkyō provided by the SAT Daizōkyō Text Database Committee. The Taishō Shinshū Daizōkyō is a definitive edition of the Chinese Buddhist canon. It also includes Japanese commentaries used by scholars.

We added a link to the text of the corresponding material in the SAT Daizōkyō Database from each bibliography page related to Buddhist study in the digital archive, as shown by the red rectangle in figure 2.

Figure 2. Links to the SAT Daizōkyō Database from a bibliography page on the Kyoto University Rare Materials Digital Archive.

The links are generated based on metadata that have been provided by researchers on the IIIF Manifests for Buddhist Studies.[18] The IIIF Manifests for Buddhist Studies is a platform that collects 8,133 IIIF manifests (the number as of May 24, 2020) regarding Buddhist study material from different institutions around the world. A IIIF Manifest is a resource defined by the IIIF Presentation API and corresponds to one piece of material. In the field of Buddhist studies, it has long been the practice to assign catalog numbers to each piece of material so that different versions can be compared. The platform enables researchers to register IIIF manifests of material related to Buddhist studies. In addition, the platform encourages researches to browse images of the material and add catalog numbers, volume numbers, and line numbers to images. This added metadata is delivered to the SAT Daizōkyō Database and is used to generate reciprocal links between the SAT Daizōkyō Database and bibliography pages in the digital archive.

In summary, this case shows a pathway in which users provide added value (i.e., metadata, including catalog number, volume number, and line number) to material. Then, the added value is given back to institutions that made the digitized material available.[19] Thus, the distribution enabled by the IIIF brings benefits to both users and institutions that hold material.

4. Evaluation of Our Digital Archive

The evaluation of digital archives is important for various reasons. First, it enables us to find better ways to digitize, publish, and share resources. In other words, evaluation might improve a digital archive. Second, we are accountable to stakeholders. Since we need to secure human resources and budgets to continuously and sustainably operate a digital archive, we continue to investigate and prove the impact of digital archives. As the importance of evaluation has become more recognized, different frameworks and guidelines for evaluation have been proposed. Here, we first introduce several evaluation frameworks and guidelines and present our attempts to evaluate our own digital archive, focusing on to what extent the material available in the digital archive has contributed to research. The importance of understanding the scholarly usage of material for further promoting and facilitating research should be considered.

4.1. Evaluation Frameworks and Guidelines

Evaluation frameworks and guidelines have been developed by different entities. For instance, the Europeana Impact Playbook[20] has developed a common language to show impact and express critical contributions to society.[21] The playbook method is designed for cultural heritage institutions to assess the impact of digital resources based on the Balanced Value Impact Model (BVI Model).[22] In the playbook, the impact is defined as changes that occur for stakeholders or in society as a result of activities (for which the organization is accountable). The BVI Model draws evidence from a wide range of sources to provide a compelling account of the means for

measuring the impact of digital resources and using evidence to advocate how change benefits people. The playbook disassembles the evaluation procedure into four phases: design, assess, narrate, and evaluate. Since the playbook is still under development, it covers only the design phase at the moment (as of May 30, 2020). The playbook provides instructions regarding how to formulate this phase by sharing matters such as what, how, and for whom evaluation is performed among stakeholders.

Another example is the "Guidelines for the Evaluation of Digital Scholarship by Historians."[23] The American Historical Association (AHA) has published the guidelines in order to provide an appropriate assessment of digital projects that contribute to disseminating knowledge of history and to further promote the development of digital projects in history.

As mentioned prior, there are various frameworks and guidelines for the evaluation of digital archives. The common principle among them is that evaluation should be made in accordance with the purpose of a digital archive. The main purpose of the Kyoto University Open Access Promotion Project, which supports the development of our digital archive, is to facilitate and promote research. Therefore, we attempted to measure to what extent the material available in the digital archive is reflected in research. First, we measured the usage statistics of the material in the digital archive. Thereafter, we attempted to measure the number of scholarly articles that cite the material in the archive, as scholarly articles are one of the major forms of research output.

4.2. Measuring the Usage Statistics

We first investigated the usage statistics since they are the most straightforward and have been referenced within many studies, including Steve Jones et al.[24] In this evaluation, we counted access usage (i.e., pages and hits), as this is the most prevalent usage statistic to measure the use of web resources. We present the number of pages and hits in figure 3. In the figure, we observe several spikes. The detailed analysis reveals that spikes are caused by media such as a newspaper or a Twitter mention of a piece of

material. Therefore, we think that it is possible to see societal impacts from usage statistics to some degree. However, it is difficult for usage statistics to indicate to what extent material is used in research output such as scholarly articles.

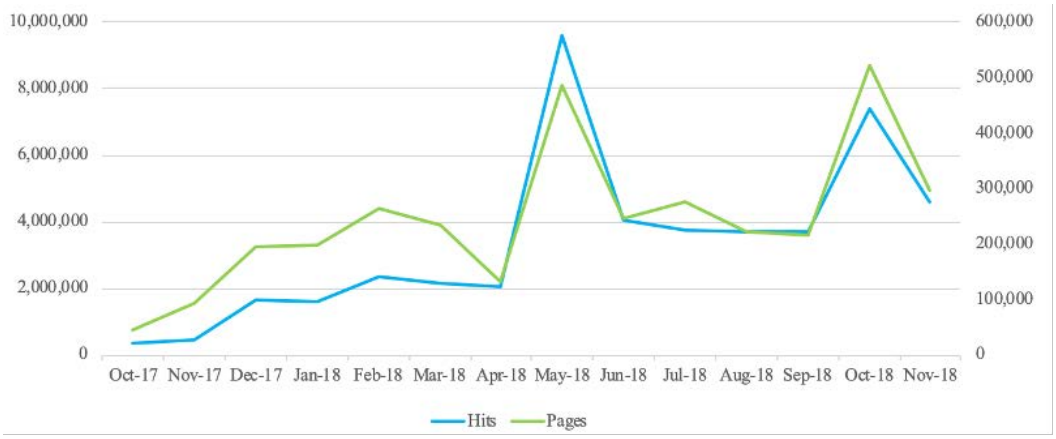

Figure 3. The number of pages and hits of the digital archive from October 2017 to November 2018. The number of pages reflects accesses to HTML, PHP, and ASP files. In contrast, the number of hits additionally reflects accesses to all files, including CSS, image, and Java Script files, which are requested as a result of loading a page. The vertical axis on the left and right corresponds to the number of hits and the number of pages, respectively.

4.3. An Attempt to Retrieve Scholarly Articles That Use Our Material

As the purpose of our digital archive is to facilitate research in humanities and social sciences, we attempted to get an idea of the scholarly articles that use material available in the digital archive. We encourage users to donate and submit scholarly output that uses material available in the digital

archive in the "Guide for Content Reuse."[25] However, we receive fewer than ten submissions per year and observe a lot of scholarly articles that use the material but are not reported to us. Thus, we needed an automatic procedure that detects scholarly articles using the material in the digital archive.

To this end, we investigated the number of scholarly articles that cite the material using the CiNii Articles OpenSearch for Full Text.[26] CiNii is a database that collects scholarly information published in Japan that includes scholarly articles, monographs, and dissertations. CiNii Articles provides services focused on scholarly articles. In this evaluation, we used the CiNii Articles OpenSearch for Full Text to return the metadata of a set of scholarly articles whose full text contains a given query. We queried titles (in Japanese) with "Kyoto University Library" (in Japanese) (i.e., [title of a piece of material] + [space] + "Kyoto University Library") in them to identify scholarly articles that cite the material. We observed that, over the past three decades, there is an increasing trend in the number of scholarly articles that cite the material. However, we found many false positives (i.e., scholarly articles identified as citing the material but did not actually cite it). Therefore, we concluded that it is difficult to accurately detect scholarly articles using our material with the CiNii Articles OpenSearch for Full Text in our case.

In addition, the usage statistics reveals that 40 percent of hits (i.e., access to all files in the digital archive) come from foreign countries such as China and the United States. This indicates that material in the digital archive is actively used and investigated by users from foreign countries. Thus, we also would like to have an automatic procedure that detects scholarly articles in English and other languages.

4.4. The Importance of Understanding the Scholarly Usage of Material

As mentioned in the previous section, we could not automatically extract scholarly articles that use the material in the digital archive. However, we believe that understanding the scholarly usage of this material is important

not only for the evaluation of the digital archive but also for supporting research, because information regarding related works of the material and how they are used will assist researchers. When searching and browsing for scholarly literature, we checked citing and cited literature to find works that were relevant to our own interests. Various academic databases and search engines presented citing and cited literature for each piece. Similarly, it is required to organize and present literature that cite rare material. This allows researchers to understand what research has been done so far on a piece of material of his or her interest.

For the organization of citations among scholarly literature and rare material, we needed to do the following. First, we defined a framework for how to cite a rare piece of material, which facilitates the development of an automatic procedure. Second, we promoted the open access of different scholarly resources in the field of the humanities. In the field, many scholarly articles remain available only in print and are not available online. In this case, it is difficult to detect citations. In addition, scholarly resources other than articles should be made available online. Researchers in the humanities produce scholarly output in a lot of various forms, including monographs. It is necessary to construct a framework for the assessment and the evaluation of different types of research outputs as an incentive to make them available online. To this end, citations among different types of scholarly resources should be made available in line with an international standard such as the one defined by the Initiative for Open Citations (I4OC) for broad distribution.[27]

In this section, we present our attempts to evaluate our digital archive, focusing on what extent the material available in the digital archive has been used. Additionally, Nagasaki pointed out that we need to assess digital archives from the perspective of their readiness for future users.[28] In other words, we need to evaluate how well a digital archive is designed to facilitate discoverability by users and how well we can grasp the use of resources. In the future, we would like to evaluate our digital archive from that perspective.

5. Conclusion

In this article, we described the development and the evaluation of the Kyoto University Rare Materials Digital Archive. We work with this digital archive to enhance resources in the humanities and social sciences and to facilitate research in these fields. Utilizing the IIIF, we also collaborated with external institutions in which material available at those different institutions is virtually displayed in one place or linked with others. Finally, we discussed the evaluation of digital archives and our attempts at evaluating our archive, focusing on the perspective of research support. We also noted the importance of detecting the scholarly use of material for research support as well as the evaluation of digital archives. Through these efforts, we hope to promote the circulation of scholarly information, including rare material, and to accelerate research in the field of the humanities.

We described our activities regarding the digital archive in the context of open access. However, open access does not mean universal access. In other words, even when we make material freely available online, this is not enough to enable everyone to access this knowledge. For example, Peter Suber[29] pointed out that there are four kinds of access barriers: filtering and censorship barriers, language barriers, handicap barriers, and connectivity barriers. In the context of scholarly articles, language barriers refer to the fact that most online literature is in English or another single language. Considering this for rare materials, most historical manuscripts are handwritten and use classical Japanese language that is difficult for many people to understand. In the future, we would like to think about how to remove those barriers and improve the usability of the knowledge found in these materials.

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